

Application Serial No: 10/067,218
Attorney Docket No.: 51995 (ACT-214)

REMARKS

Entry of the foregoing, reexamination and reconsideration of the subject matter identified in caption, as amended, pursuant to and consistent with 37 C.F.R. §1.112, and light of the remarks which follow are respectfully requested.

Claims 1-33 are pending in the application, new claims 32 and 33 having been added above. Claims 32 and 33 point out further aspects of the invention, support for which can be found at least in original claim 15 and Figure 4, respectively.

At the outset, the indication of allowable subject matter with respect to claims 4 and 5 is noted with appreciation.

By the foregoing amendments, claims 1-3, 7, 8, 15, 16, 19 and 23 have been amended. Claims 1, 3, 7 and 8 have been revised to delete the "step" language. Claims 15 and 16 have been revised in response to the §112 rejection. Claim 15 has further been amended by deleting the recitation relating to the pit inhibiting the formation of a wedge. The dependency of claim 19 has been corrected. These amendments do not narrow the claim scope. Claim 23 has been revised to point out that the substrate is silicon and that the optical fiber is mounted in the wet-etched sections of the tapered groove. Support can be found at least in original claim 15 and Figure 6, respectively.

Claims 15-22 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite. This rejection has been obviated by the foregoing amendments to claims 15 and 16. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 1-3, 6-10, 12-14, 23 and 25-31 stand rejected under 35 U.S.C. §102(b) as being clearly anticipated by *Tabuchi* (U.S. Patent No. 5,611,006). In addition, claims 11 and 15-22 stand rejected under 35 U.S.C. §103(a) as being obvious over *Tabuchi*. These rejections are respectfully traversed for at least the following reasons.

As described in the "Background" section of the present application, some optical devices require V-grooves having a depth that varies along the length of the V-groove. As the depth of such V-grooves decreases, the V-groove width tapers inwardly. A disadvantage in anisotropically etching varying depth V-grooves in <100> silicon is that such V-grooves are difficult to make because a tapered mask used to pattern the varying depth V-groove does not align with the <111> crystalline planes of the substrate. Although a varying depth V-groove can be made in a <100> substrate by cutting the

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substrate at an offset angle and then etching in the V-groove with an anisotropic wet etchant, this is an expensive undertaking.

Through the present invention, applicant has provided techniques for forming V-grooves of varying width and V-grooves formed thereby which address the problems associated with the state of the art. Claim 1, for example, sets forth a method for forming a V-groove in a substrate having a varying width. The method involves dry etching at least one pit in the substrate; coating sides of the at least one pit with a material which is resistant to a wet etchant; and wet etching sections of the substrate, wherein the at least one pit projects into the sections.

Independent claim 15 sets forth a tapered groove formed in a <100> silicon substrate. The tapered groove includes a pit in a <100> silicon substrate and at least two wet-etched sections in the <100> silicon substrate. A first said wet-etched section has a different width than a second said wet-etched section, and the pit extends into the first and second wet-etched sections.

Independent claim 23 sets forth an optical coupler. The optical coupler includes a silicon substrate having a tapered groove formed of a plurality of spaced apart dry-etched pits joined together with wet-etched sections of varying width. An optical fiber is mounted in the wet-etched sections of the tapered groove.

Based on a complete understanding of the present invention, it is respectfully submitted that *Tabuchi* does not disclose or suggest each feature of the present invention.

Tabuchi relates to an integrated optical device, and more particularly, to a hybrid-type integrated optical device having optical components such as laser diodes, photo-isolators, and photodiodes integrated on a single substrate (col. 1, lines 8-12). In making the rejection, the Examiner relies on the device depicted in Figure 14 of *Tabuchi*.

Tabuchi does not disclose or suggest each feature of the present invention. For example, *Tabuchi* does not disclose or even remotely suggest a method for forming a V-groove in a substrate having a varying width, wherein at least one dry-etched pit projects into wet-etched sections of the substrate, as set forth in independent claim 1. As described in more detail in applicant's specification with reference to the exemplary embodiment illustrated in Figures 2-3, diamond-shaped pits 30, 32, 34, 36 are provided which extend into the V-groove sections, as such structures can suppress the formation of

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wedges in the V-groove. The specification further states that any shape which provides a projection into the V-grooves section may be used (specification at section 25). What the Examiner refers to as "dry etched sections 25a-e" simply do not "project into" the purported "wet etched sections 24, 42a-d" of *Tabuchi* (see Official Action at page 2). Accordingly, withdrawal of the rejection with respect to claim 1 and the claims dependent therefrom is in order.

For at least the reasons set forth above with respect to claim 1, the rejection with respect to independent claim 15 should be withdrawn as well. In this regard, *Tabuchi* does not disclose or suggest a tapered groove formed in a <100> silicon substrate, wherein a pit extends into first and second wet-etched sections.

Regarding independent claim 23, *Tabuchi* does not disclose or suggest an optical coupler, having wet-etched sections of varying width and an optical fiber mounted in the wet-etched sections. The optical fiber 23 of *Tabuchi* is disposed in a conventional V-groove 24 having a single width. Since spherical lens 16d sits in region 25d adjacent the end of the optical fiber, the optical fiber cannot extend into region 42d, which is on the opposite side of the spherical lens from the optical fiber.

For at least these reasons, withdrawal of the rejections based on *Tabuchi* is respectfully requested.

Claims 23-27 stand rejected under 35 U.S.C. §102(b) as being clearly anticipated by *Takahashi* (U.S. Patent No. 5,339,377). This rejection is respectfully traversed for the following reasons.

Takahashi relates generally to an optical fiber splicer for ribbon-shaped optical fiber cords for ribbon-shaped optical fiber cords (col. 1, lines 6-7). The optical fiber splicer includes an aligning member and a cover member adapted to cooperate with the aligning member to allow sheathless optical fibers to be received in substantially V-shaped grooves (col. 1, lines 17-21). Each of the aligning member 11 and the cover member 20 is molded of a synthetic resin in an injection molding die. (Col. 7, lines 40-65).

Takahashi does not disclose or suggest each feature of applicant's invention. For example, *Takahashi* does not disclose or fairly suggest an optical coupler that includes a silicon substrate having a tapered groove formed therein. As described above, *Takahashi*

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discloses use of a synthetic resin formed in a molding process. A synthetic resin substrate is in no way suggestive of a silicon substrate.

As a further note, applicant notes the Examiner's taking of Official Notice with respect to the claimed U-grooves. Applicant respectfully requests that a prior art document be provided in support of this position.

Finally, the newly presented claims are believed to further distinguish over *Takahashi*. In this regard, *Takahashi* does not disclose or suggest a <100> silicon substrate or that the dry-etched pits have a width greater than the width of the adjoining wet-etched sections.

For at least the reasons set forth above, withdrawal of this rejection is respectfully requested.

From the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order, and such action is earnestly solicited.

If there are any questions concerning this paper or the application in general, the Examiner is invited to telephone the undersigned in order to expedite prosecution.

Respectfully submitted,



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